

REDUCING THE NEED FOR LABOR BY MECHANIZATION AND BETTER WORK METHODS

by

Dr. R. M. Carter*

While our farm labor utilization people in Vermont have done a fine job during the war years in securing the help of city boys and girls, and of some foreign workers, for our farms, migratory labor, as we usually think of it, has not been as much of a problem in our State as it has been in other sections, as previous speakers on this program have indicated. We have quite as great an incentive, however, for reducing the need for labor as have the rest of the States, since wages paid per month for hired help have risen 315 percent above the prewar level, and these same men are now working, on the average, 2 hours per day less than are the farm owners.

The pressure which is being applied to our farmers all over the Nation as a result of changing economic and social conditions, the demand which is being made for more and more money for less and less work, may be increased materially in the next few years if the current trend toward lower prices for farm commodities continues. Many of us who are particularly interested in helping farmers with their labor problems see only one happy solution to this matter: an increase in the productivity per man hour for all farm workers.

I regret that I lack an intimate acquaintance with many agricultural operations. My own experience as a research man has been limited to working with farmers on their problems in the harvesting of hay and in the chores about the dairy barn. The examples I shall use to illustrate my points in this discussion are drawn from these studies, and may not hold in other parts of the United States.

I think there are two satisfactory ways of reducing the need for labor on our farms.

One of these methods of obtaining greater production per worker is by increased mechanization of the farm. This method of approaching the problem has been applied in industrial organizations in all parts of the country with great success, and it is currently thought of as the farmer's great opportunity to emancipate himself from a great deal of drudgery.

"Mechanization," according to Webster, "is the replacing of personnel with machinery wherever possible." It involves the use of machinery, of tools. There are three possible groupings of such tools. There are tools of an elementary type, hand tools, whose efficiency of operation is conditioned in every way by the abilities of the workmen using them. These include hoes, shovels, brooms, wheelbarrows, pitchforks, etc. They are scarcely even mentioned

*Presented by Dr. R. M. Carter, Rural Sociologist, University of Vermont, Burlington, Vermont, at the Regional Farm Labor Conference of the Cooperative Extension Service and Labor Branch, PMA, U. S. Department of Agriculture, at Atlantic City, N. J., January 29, 1947.

in the same breath with that magic word, mechanization, but should never be ignored. They are used far more hours per year on our dairy farms than are other forms of machinery. They satisfy our definition in that they permit one man with tools to accomplish as much as could several men utilizing their bare hands. Within limits, our farmers should provide themselves with all indicated elementary tools. They are relatively cheap, and should be kept in first-class condition. Duplication of these tools is often an economy. One dairyman, for example, provided four hoes for use in his barn. These four hoes, used to remove manure dropped on the platform during milking, when properly distributed, saved him approximately 300 feet of travel twice each day. In another case a simple tool, a second milk strainer, was added to milk-room equipment. Saving in straining time by this single change cut over-all time by 16 minutes per day, because faster handling of the milking machines became possible.

There is a second grouping of tools which I shall term semi-automatic. Tools in this group are power driven. The milking machine and the semi-automatic hay baler are two examples. The proper operating speed of these machines is fixed within certain limits. The operator cannot hurry the machine, but unless the operator keeps up with the machine, the efficiency of such machines is often seriously curtailed. To draw examples from research done in Vermont, less than 15 percent of the milking-machine operators in our State in 1942 were able to keep up with machines. Aside from the economic loss involved on 85 percent of our farms by failure of operators to "make the grade," there were also serious losses due to reduction in production, udder injury, and milk quality. For another of our semi-automatic machines, the 3-man hay baler, our records showed that last year about 5 out of every seven machines were held back through the inability of the men handling them to keep up with the machinery. Mechanization which involves semi-automatic machinery brings with it problems of worker training, and of a special type of coordination between workman and machine which were not acute in the case of elementary tools.

Fully automatic machines are not limited by the human factor to any appreciable degree. The barn stable-cleaner, for example, which involves the pressing of a button to remove manure from the gutter to manure pile or pit, works at the speed predetermined by the manufacturer. The same condition is true as regards such field machines as the 1-man, or fully automatic, hay baler. Here, since ties are made by mechanical fingers, operator skill and training do not enter into the picture. When smaller bales are desired, the knots are made at more frequent intervals. There is no rider in danger of getting thrown off when the going gets rough. Mechanical fingers are prepositioned. As long as fully automatic machines are properly adjusted, an understanding of the correct method of operating these machines is not needed.

These statements concerning the way in which mechanization is solving farm problems cannot go unqualified. If we are to suggest mechanization as one method of reducing the farmer's need for labor, we must give out certain warnings, or danger signals concerning mechanization which involves the use of semi-automatic and fully automatic tools.

The first of these cautions, pointed up by our Vermont haying studies, is that to be successful semi- and fully-automatic tools must be used together in efficient combinations. The field hay chopper, for example, requires the concurrent use of other equally modern equipment items, as large, high-sided trucks or trailers, preferably equipped with automatic unloading devices, large capacity blowers, and ample power. The farmer who wants to bale hay efficiently cannot afford to pick bales off the field by hand and lift them onto high platform hayracks, draw them to the barn by horses, and finally lift them off the rack by hand into the haymow where they are carried into place and piled. Indeed, he needs high speed trucks of large capacity, bale loaders or trailers, unloading devices at the barn, and conveyors within the loft itself.

Another caution is in the matter of repairs. Servicing of mechanical equipment is of prime importance. Lack of a small part, which may take but 5 minutes to replace in a machine, held up haying operations on one farm for 4 days. The owner had to travel 540 miles in his car to secure the unit from a dealer in Massachusetts. A bale elevator broke down on one farm where I was checking operating time, and a crew of four men stood idle for 8 minutes while the fifth man repaired a broken link in the drive chain. Total loss of time: three-quarters of an hour.

The amount and type of help available is also related to the part played by mechanization in reducing the need for labor. The milking machine is an example of a semi-automatic tool whose introduction almost invariably increases output per hour. But as previously pointed out, labor of improper quality can definitely limit the effectiveness of this tool.

There is a physical barrier on some farms which may make mechanization unwise. We should be careful about recommending some types of farm machinery for field operation in certain areas. One of the most efficient hay harvesting devices studied in Vermont was the field chopper. It has a splendid operating record on our stone-free clay areas. One farmer in a rocky section, however, introduced a field chopper into his operations, and ruined a \$1,400 unit in a very few minutes. He finished haying with the old-fashioned loader, and 2 years later the automatic machine was still standing, unused, in a corner of his shed. There is another type of physical barrier on some farms which might also be mentioned, as introduction of more equipment than the existing labor force can handle. I know of several instances where there are three separate tractors on 3-man farms. One farmer who milks alone tries to use four milker pails. Men seeking relief from their labor problems sometimes advance too rapidly or too far into a mechanization program.

Some farmers are only concerned with speed in getting their work done, and are not particularly interested in the number of workers needed at a given time. Farmers in Vermont who use the loose hay loader hitched behind a hay rack, for example, had haying crews of about three workers per farm. Farmers who use hay balers usually utilized at least seven men at one time. The most efficient individual we found in our haying study that handled baled hay had 10 men working all the time: the operator of the fully automatic baler, six men operating two trucks which shuttled back and forth between field and barn hauling and unloading hay, two men who were kept busy in the haymow placing the bales, and yet another

man who kept hay mowed and raked ahead of the baling crew. On the other hand, many farmers feel they must get their work done with the regular farm help. An entirely different meaning must be given to mechanization when dealing with farmers who have this second problem.

I cannot leave the subject of the relation of mechanization to type of worker without some comment concerning individual capabilities. I feel that many of the boys and young men working on farms as operators and hired hands enjoy working with power equipment. But power equipment often establishes a speed for workmen as well as a draft on their energy which is in excess of that needed when simpler horse or hand-operated tools are used. Studies show that the number of women and children employed in the hay harvesting crew declines as mechanization increases. While there are exceptions we can all call to mind, women, children, and old men have little or no place in field operations of the magnitude of fully mechanized hay harvest. Our problem of supplying help for farm operators under mechanized conditions, while simplified in some degree by a greater willingness of young men to work with power equipment, is complicated by need for more workers per farm for jobs of limited duration. Many of the more mature farm workers, moreover, have become aware of the sometimes killing pace set for them by power machinery, and are less easily attracted to farms using automatic machinery after one or two seasons. As one farm laborer said to me, "This hay field probably looks pretty nice to the boss sitting out there in his big car watching us poor devils at work. This is the last time I'm going to hay. I get home every night so tired I can't see, and get up each morning with every bone aching. He's paying us a dollar an hour, but it's back to my good old 70 cents, come Saturday."

The operation of power machinery is frequently accompanied by accidents. Inexperienced or immature operators frequently encounter trouble. In the past 2 years we have had between 7 and 10 tractors capsized while driven by women or children. One man lost an arm in a hay baler. Less serious are the economic losses sustained by some farmers through equipment breakdowns. One farmer hired a school boy at 75 cents a day to drive a tractor hauling a hay baler costing over \$2,000. The boy became rattled, reversed the tractor, and smashed equipment to the tune of \$375, plus a delay of 2 weeks. If farmers are to mechanize, we must recognize a responsibility of bringing to their attention the need for well-trained and physically able operators.

Finally, we must consider mechanization, if it is to be recommended to farmers, in terms of its effect upon good farm management practice. Some machinery is used a great many days each year on the home farm, and never for custom work. Other farm machines are needed but a few days each year on the home farm, but can be employed for additional periods in helping other farmers. Farmers buying the first type of equipment, as the milking machine, will probably use it 730 times each year, with an investment of \$350-400. Savings resulting from mechanical as compared with hand milking, on a 20-cow herd, would come to at least 700 hours per year. Such an investment, figuring labor at 50 cents per hour, would pay off in one year. Suppose this same 20-cow farmer installs an automatic gutter cleaner for removing manure. The investment for this item would be between \$850 and \$1,200. It would do the work in from 7 to 10 minutes per day, as compared with about 12 to 20 minutes by a man with a wheelbarrow. This saving of about 10 minutes per day, or 60 hours per year, would apparently save about \$30 per year, but we must not neglect interest, repairs, depreciation, etc., inconsiderable charges for the worker

with wheelbarrow and shovel, but of major importance for the owner of the automatic gutter cleaner. Even without these expenses, however, it would take 33 years to recover the original cost. These economic costs, these permanent charges which may be saddled upon a farmer seeking to reduce his labor requirements by purchase of machinery; should be pointed up to him by extension workers seeking to help him with his problems.

Recommendation of use of farm machinery to farmers as partial solution to the labor problem is a glamorous one. The machines themselves, while reproductions of them do not exactly make pin-up pictures, have similar attributes. They have color, they have size, they have "lines," and they are definitely expensive. The farmer who mechanizes his farm gains status in the eyes of his neighbors. Possibly his sons will resist the lure of the city, and stay home to operate these fascinating tools. The owner of semi-automatic and automatic farm machines will probably get his work done ahead of farmers who use more elementary tools.

The second proposal which I have for reducing the need for labor lacks most of these attractions, and will often give rise to objections from farmers to whom it is recommended. Men do not like to be told that they need to improve their work methods, and most of them feel, rightly, that they know more about their own problems than does a stranger. Never the less, only from 12 to 20 percent of our farmers get fairly satisfactory results with hay harvesting tools; between 80 and 90 percent of our farmers might increase their efficiency from 30 to 70 percent without spending a dollar or adding a single piece of new equipment if they understood the better ways of doing a job.

Four types of information are needed by farmers who seek to reduce labor requirements by applying better work methods on their home farms. The efficient farmer must understand, first, the use of the body to do work with least consumption of energy; second, the essentials of a good boss; third, the relationship between type of tools and equipment to be used and the size of crew to be employed; and fourth, the better way of manipulating the tools available for use on the job.

A good start has been made toward the education of workers concerning proper body control. Several States have produced publications along this line which workers on the farm labor program have used to good advantage. The same holds true for labor management. The various training programs sponsored by the farm labor program contribute toward this end.

Our experiences in Vermont as related to crew size appear to be borne out by experiences reported in other States. Especially in barn chore work, the fewer individuals working together at a single job, the lower the time requirement. In milking, for example, repeated experiments show that one man working alone can milk the same number of cows in less than twice the time required by two workers. When three men work together at the milking job, there is actually no increase in output, and sometimes an actual loss is found, as compared with the output of two men, each working by himself. While we have had no opportunity for controlled experiments at the hay harvest, our studies

show that, with given equipment, efficiency decreases when more than the minimum number of workers are employed at a single job. We have actually found that hay is loaded by hand at a lower time cost per ton when one man worked alone in the field, than when two men worked together. One man alone pitched on, drove, and loaded a ton of hay in 47 minutes; the most efficient 2-man competitive crew required 63 minutes. In one Vermont dairy barn two men together milked 26 cows in 1.2 man-hours. After discharging his helper, this same farmer was able to do an identical job in .9 hours. One lesson which might be learned from these experiences, is that there are dangers some farmers will encounter in reducing labor costs, if they actually do obtain the extra help which many of them now feel they require.

It is in the fourth consideration, that of bringing to the attention of farmers the importance of knowing how to make better use of the facilities on hand that we have gone farthest in Vermont, although our efforts have been limited to work with farmers in their dairy barns. The lines of self-help followed by farmers interested in getting a greater amount of work done on time during a period when it was impossible to increase the work force in number.

1. Examination of the working area.
2. Discovery of the accomplishment of other farmers working under similar conditions.
3. General improvement in regularity and in timeliness.
4. Inspection and reconditioning of tools used.
5. Development of improved work routines.
6. Rearrangement of stable.

The farmer who starts out on a methods improvement program by cleaning house can seldom go wrong. When he goes into his barn, his milk factory, and starts cleaning house, he usually surprises himself. The amount of rubbish which will be piled up by the farmer who removes every item that has not been used within the last 30 days, is an impressive one. It is a mighty good start, since clutter of any kind reduces efficiency. Don't hope to get it all. The most efficient farmer I ever knew refused to move a milk scale which he hadn't used for 5 years. He said he had to keep something useless around in order to feel at home.

During the process of cleaning up, the farmer will usually learn considerable about the achievements of other farmers. If a milk stool is discarded, it is probably because it comes to mind that a neighbor gets along at the stripping job without sitting down permanently. Much of the material which the farmer has read in farm journals which relates to the subject will be recalled. If we work with a farmer in our State, we try to supply him with station publications which give survey results, as of time

spent by other farmers at various barn chore jobs, and encourage their study. I remember I once loaned an interested farmer a very technical bulletin related to milking, which I had obtained from another State. When he returned it to me, he remarked that there was a whole lot in it that he didn't understand, but that it certainly looked as though some other people spent a lot less time milking than he did. I didn't say anything more, as that was about all that I had gotten out of it. Apparently we both got the point of the article.

The lesson of regularity and timeliness is a hard one for farmers to learn. It is probably of utmost importance in crop production, but even in other fields if you can show farmers that it pays dividends they will pick it up. Most good dairymen have developed regular habits in connection with their herd work, and the less efficient may be encouraged to emulate these better farmers. I once got a farmer interested in the matter of "timeliness," by demonstrating to him the improved condition of teat-cup inflations which had undergone a rest period of a week immersed in lye solution. This farmer, from that time on, kept two sets of rubber inflations on hand, and the extra set provided replacements without delay when the working set developed leakages. Previously, this farmer used defective liners for one or more milkings, until a trip to the city could be arranged. Timeliness in this case resulted in equipment capable of doing a good milking job at all times.

Timeliness, of course, is related to the keeping of equipment in good condition. The "forhanded" farmer will have repair parts on hand before they are needed. Drive belts will be kept tight. I once visited a farmer who had 22 out of his 24 steel cow stanchions defective at one or more points. One night a cow broke loose, got into the milk room, and upset \$11.40 worth of milk. The next day, without any argument, we went down the stanchion line, removing the baling wire, rope, chain, and other foreign contrivances. The total time required to replace lost bolts and nuts, to straighten bent tubing, etc., for the 22 stanchions, was something over 3 hours for the two of us. Savings which were made daily in tying and unloosening this herd as a result of the reconditioning came to about 5 minutes a day. It took quite a time to get caught up from several years of laxness, but the loss of three cans of milk was probably a cheap price to pay for the lesson this farmer learned.

You probably feel by now that labor efficiency as we see it in Vermont is not scientific; that it is only the application of good common sense. I heartily agree with this second criticism, and am rather proud of it. If our recommendations were not sensible, no matter how scientific, farmers would not take them up. I feel, however, that they are also scientific.

The analysis of one's own work pattern is very difficult for many farmers. In Vermont we have studied carefully one very important barn job, milking, and have formulated a fairly good work routine for that job. This is presented in an extension circular. We find that if definite, step-by-step rules can be given a man for something important to him, something in which he is interested, rules which can be depended upon to attain almost guaranteeable results when carefully followed, a great step has been taken along the way toward a complete adoption of better work methods. A farmer who takes up the advised milking program can milk his herd at the rate of

24 cows per man hour. Some do much better than this. The first farmer I ever worked with on this problem was originally leaving the milker on his cows for an average of $8\frac{1}{2}$ minutes. This was about 2 minutes longer than the Vermont average at that time of $6\frac{1}{2}$ minutes. When he adopted the standard procedure, his average time fell to 4 minutes per cow, and the total time saving was enormous.

Another farmer we worked with was spending about 4 minutes per cow at the onset. This farmer eventually whittled the time down to $2\frac{1}{2}$ minutes. In each case, however, the important thing is the confidence gained by the farmer in the results which can be obtained through better knowledge of how to perform some of the old, established jobs.

Farmers will perform some experiments themselves. For example, they have discovered that, for individual workers, differences are small. Two strange men, using identical tools on alternate days, in the same barn and for the same herd, removed the manure in 22.51 minutes and 22.53 minutes, respectively. Yet to watch these workmen, as I did, you would have sworn that one was much slower than the other.

In another case a farmer discovered that if he swept his barn by making a circuit down the left-hand side and back on the right it took him $1\frac{1}{2}$ minutes longer than when he reversed the circuit. A small saving per day, it is true, but it is certainly important that farmers are beginning to investigate and discover these facts, which nearly amount to scientific laws. And at the same time they are piling up, minute by minute, savings which amount to hours per week, and days per year. Once a farmer begins to think about his common, everyday jobs, once he begins to question established procedure, the many economies which are possible by shortened travel routes, the removal of disturbing conditions, orderly work habits, and integration of related jobs, become evident.

I have said nothing as yet concerning barn rearrangement. This is the subject of most interest to farmers, but the last one which should be investigated by them. Until a farmer has shown his ability to follow improved work routines, he is in no position to remodel his stable. Until a farmer has come to recognize the interrelationship of all chore jobs, he is not competent to pass upon desirable modifications of the existing pattern. In general, farmers can make major savings through the adoption of better work routines. If they can do this, further minor savings can usually be made by changes in the existing barn itself. We know improved work routines reduce the need for labor. Improved stable rearrangement will mean little to the farmer who fails to recognize the benefits he can derive from improved work patterns. It is not a matter of money, either, although that is a factor. One friend of mine remodeled his barn unwisely, spent over \$3,000, and had to hire an extra man to do the work in the new, highly inefficient structure. Another farmer, with a structure originally far worse, spent less than \$50 and made savings which can conservatively be estimated as $\frac{1}{2}$ hour a day.

Changes in barn arrangement, once made, must be lived with for a long time. Even if estimated savings come to $\frac{1}{2}$ hour a day, that much time, at 50 cents an hour, amounts to less than \$100 a year, and economically could

justify changes of less than \$1000. So we encourage our farmers to consider all other methods of reducing labor before making any changes in their barn, that they consider changes from all angles before proceeding, and that where possible the changes be made very slowly and with the minimum of cash expenditure. Despite the current labor shortage, the reduction of a few minutes per day in the time used in chore jobs may not be worth the price which must be paid in high fixed charges during the years ahead.

In conclusion, I feel we have learned a few lessons from our labor studies in Vermont which may have general application. In the search for ways of reducing the need for labor on the farm, there are at least two broad avenues we may follow, as well as many narrower corridors.

The first of these, called mechanization of our farms, is not without its obstacles and pitfalls, since unquestioning acceptance of it may lead us into greater labor difficulties, introduce unsolvable mechanical problems, or complicate our financial structure. Under some conditions, farm help may resent the introduction of high-pressure machines. The large crews and short duration of the job on individual farms may appear as obstacles to be overcome. Not all farms, moreover, are adapted to mechanization, because of restricted size, topography, or other factors. Yet again, capital investment must be watched carefully, to avoid creation of a fixed expense burden which might overwhelm the farm operator should we enter a period of depression.

The second avenue along which we may seek relief, is through better work methods. If we follow this trail we have a job of worker-education ahead of us of a magnitude difficult to even imagine. Properly stimulated, however, many farm workers will do much of the work themselves, through self-education of the experimental and investigative type, as indicated in some of the examples I quoted earlier. Better work methods almost invariably result in reduction in the need for labor, require little or no additional investment, and seldom complicate the labor picture.

A farmer can reduce his need for labor, according to our Vermont studies, either by increased mechanization or by improved work methods. Both ways of attaining the same end should be weighed carefully by men interested in the farm labor program, and recommendations made after giving some account to individual situations. The knowledge which you have, this more complete understanding of the labor problem, is both an opportunity and an obligation. Farm people will welcome your advice, but any advice you may give them along these lines should be very carefully considered.

